asphyxiation, plus an irregular anesthesia to contend with. In either event, the nicest judgment and skill are necessary to conduct a safe and satisfactory anesthesia. Nitrous oxid cannot be administered by any automatic machine; neither can any other anesthetic, as neither patient nor operators are automatic.

Nitrous oxid-oxygen given with ether again complicates the physiologic workings of the anesthetic. Nitrous oxid with "just a little ether," or with more than "just a little" given continuously throughout an operation should not be considered as a nitrous oxid anesthesia at all, but as an ether anesthesia modified by nitrous oxid.

Nitrous oxid-oxygen-ether anesthesia does not present nearly the difficulties in administration as does nitrous oxid-oxygen without the ether. Ether is a respiratory stimulant and counteracts the depressing action of both nitrous oxid and morphin. It is much more powerful as an anesthetic agent, volume for volume, than is nitrous oxid. Therefore those who give "just a little ether," say 1 or 2 per cent., throughout an entire operation (which in some cases may mean 2 or 3 ounces), are able to use possibly 5 or 10 per cent. less gas, for which oxygen can be substituted, which is from five to ten times the leeway allowable when ether is not used, and when a difference of 1 per cent. in the gas or oxygen spells success or failure.

I maintain that when ether in any amount is given continuously during an operation the anesthesia is essentially an ether anesthesia and the patient is subjected to the dangers and disagreeable after-effects of ether. Judging from the amount of ether some administer with the gas-oxygen, these gases simply serve to vaporize the ether, an expensive and unnecessary procedure, as the skilful anesthetist can conduct an ether anesthesia even for prolonged operations with from 2 to 4 ounces of ether without the gas. When the ether is given only for a few minutes early in the anesthesia this is also essentially an ether anesthesia until all ether effects have been eliminated.

I do not wish to appear as condemning this combination, as there are cases in which anesthetization is unsatisfactory or impossible without ether, and if anesthesia by the use of an ounce of ether plus the gas and oxygen is satisfactorily maintained, I believe that the patient is better off than if he has taken 3 or 4 ounces of ether without the gas and oxygen; but these should not be called nitrous oxid anesthesias. To summarize:

1. Nitrous oxid-oxygen is not the safest anesthetic for the occasional anesthetist, and should be administered only by the expert.
2. The number of physiologic factors involved are greater than with any other anesthetic.
3. A preliminary injection of morphin should always be given.
4. Ether modifies the anesthetic and makes it easier to administer, but subjects the patient to the dangers and disagreeable after-effects of ether.

41 Groton Building.

Recent Work in Anesthetics.—Although the foundation of most of our knowledge of the action of anesthetics has been laid bare through experiments with chloroform, clinically and in the laboratory, it now appears that both physiologists and anesthetists are beginning to regard this drug as having yielded to us all it can, and are turning their attention elsewhere. In America, as we have seen, ether holds the field to a very large extent, although at the moment that field is being encroached on by administration of nitrous oxid and oxygen.—J. Blumfeld in *Practitioner*, London.

RESUSCITATION FROM DROWNING

CONTINUED PERSISTENCE OF HEART-BEAT; DEATH FROM NON-RESUSCITATION OF THE RESPIRATORY CENTERS

FREDERIC WADE HITCHINGS, S.B., M.D.
CLEVELAND

The frequent occurrence of drowning-accidents during the summer serves to emphasize the need of a thorough understanding of the principles underlying resuscitation, and particularly the fact that success ultimately depends on preventing permanent injury from anemia of the brain. There is need of extensive series of figures based on accurate observation of similar accidents which will show the important part the time element bears in such cases. In the following case, while resuscitation was not accomplished, the facts seem to be worth recording because the heart continued to beat for so long a time while artificial respiration was being given:

The patient was a strong, well-developed man, aged 28, who had apparently been seized with cramps while swimming in about 7 feet of water. When attempts were made to get him out of the water he struggled so hard that he not only prolonged the efforts but also nearly drowned two of his rescuers. In all probability he was submerged between four and five minutes. After he was brought ashore the water was pressed out of his lungs at once, his tongue was drawn forward, and artificial respiration was begun by the Sylvester method.

On my arrival, about fifteen minutes after the accident, I found the patient with markedly cyanotic face and no radial pulse. I at once gave him a couple of sharp slaps over the heart, and turned him over on his face so as to continue the artificial respiration by the Schäfer method. Within the next few minutes feeble heart-sounds could be heard with the stethoscope, and a little later a faint pulsation at the wrist could be obtained. In the meantime Dr. J. B. Austin had been sent for at my request, and from this time on we worked on the patient together, Dr. Austin confirming the subsequent findings.

At the end of about half an hour after the beginning of artificial respiration the face began to be a little less cyanotic, and three slight spontaneous respirations were obtained. Oxygen was then given continuously. It seemed as if success would ensue, but in spite of strychnin, one-thirtieth grain, and epinephrin, 10 minims of a 1:1,000 solution, being given intravenously and massaged thoroughly toward the heart, it was impossible to bring back spontaneous respiration. The heart continued to beat until two hours and ten minutes had elapsed, the artificial respiration being given for a total time of two hours and fifteen minutes, and the oxygen for the last one and three-quarters hours of that time.

This case illustrates the well-known fact that efforts at resuscitation should be used for at least two hours after apparent death, although I do not believe it is of any use to do this for so long a time in case of persistent absence of the heart-sounds as shown by careful stethoscopic examination. In this regard in another drowning case which I was called to attend a few days previously, a 14-year-old boy had had cramps and been submerged between five and ten minutes—probably nearer ten minutes than five. No heart-action could be detected and as I saw him after there had been no evidence of heart-action for about twenty-five minutes the case at once seemed to be hopeless. Resuscitatory measures had been maintained for three-quarters of an hour when a drop of ether was placed in one eye (d'Halluin). No reddening was caused, confirming the previous finding that there was no circulation. The artificial respiration was continued for an hour longer without result—really unnecessary effort in the face of two such negative tests.

The heart may continue to beat for as long a time as five minutes after cessation of respiration, although it usually stops in two or three minutes. Add to a *possible* five minutes the seven minutes during which the brain may be completely resuscitated after total cessation of the heart-beat, a *possible* maximum of twelve minutes of relative death may be undergone with recovery. If this period of twelve minutes is exceeded "recovery" may take place, but without return of consciousness, or with destruction of some of the higher centers. Moreover, if the heart does not pump a sufficient stream during the first five minutes the time is shortened. Another dangerous factor tending to shorten this time is the degree of violence with which the water enters the lungs when the accident happens.

In case preparations can be made inside of this twelve-minute limit the attempt should be made to inject epinephrin in normal saline solution into a radial artery toward the heart (Crile). In this way the coronary blood-pressure can be raised and the heart made to resume its action. Doing this on the field would mean taking chances as regards infection, but with a life at stake it would be legitimate to make the effort. The hands of the operator and the wrist of the patient could be sterilized with tincture of iodin. No anesthetic would be needed, nor could it be used if at hand. The needle, tube, reservoir and saline solution would have to be in a portable form ready for instant use.

In the case reported above, failure to resuscitate was due principally to irreparable damage having been done to the respiratory centers in the medulla by anemia. In this case there was no indication for using the saline-epinephrin intra-arterial infusion because the heart was resuscitated without doing so. The intravenous injection of epinephrin and strychnin must have been dispersed through the circulatory apparatus, but epinephrin and strychnin will not cure cerebral anemia — they merely enable the circulatory mechanism to work more efficiently.

With the exception of the Brosch-Sylvester method, the Schäfer method of giving artificial respiration gives the greatest respiratory exchange per movement of the thorax. When, in addition to this, the facts are considered that the tongue automatically falls forward, that there is free drainage from the lungs, and that long-continued application can easily be made, it is undoubtedly the best method to be used in drowning-accidents.

10406 Euclid Avenue.

The "Drug-Action" of Anesthetics.—Richard Gill, chief chloroformist to St. Bartholomew's Hospital, maintains that the "drug-action" of all anesthetics is similar; they are all oxidized in the blood into inert bodies; they deprive the red cells of their oxygen. The hot nascent oxygen of the red cells readily oxidizes them, whereas the diluted oxygen of the air does so only with extreme slowness. The red cells at first offer a resistance to this demand for their oxygen. The resistance progressively diminishes. Less and still less anesthetic is needed during a long operation as the minutes pass, and much more anesthetic is needed to break down the first resistance (induction) than is subsequently needed to deoxidize cells already beaten by the anesthetic (maintenance). The oxygen instead of feeding the body tissues is confiscated by the anesthetic; hence the "anesthetic state" is one of oxygen starvation. An oxygen-starved brain and nervous system is improperly nourished, and cannot function fully; hence unconsciousness and immobility.—J. W. Bean in *Australasian Med. Gaz.*

THE ABILITY OF MOTHERS TO NURSE THEIR CHILDREN *

J. P. CROZER GRIFFITH, M.D.
Professor of Pediatrics in the University of Pennsylvania
PHILADELPHIA

Perhaps this topic may well be opened by emphasizing the necessity for women to nurse their children, particularly as so much misconception exists regarding this, not only on the part of the laity, but of physicians themselves. I have heard expert physicians say that they have little fear of difficulty in feeding an infant artificially if only they can have the charge of it from the beginning. I thoroughly agree with the necessity of the early control by the pediatrist in order to avoid the digestive disturbances which so readily arise. The difficulty is thereby lessened, but by no means removed. I cannot share the optimistic view expressed. There may exist the man who can, under these circumstances, feed infants as successfully artificially as at the breast, but I have yet to meet him. Certainly, all statistics indicate the contrary. A few of these may be of interest.

INFANT MORTALITY AND INFANT DIET

The oft-quoted extensive studies of Eröss,[1] based on the vital statistics of thirteen European countries, covering a number of years, show that the average mortality in the first year of all children born alive is 18.33 per cent. The United States Census Reports[2] for 1890 give a very similar figure — 18.29 per cent. for the registration area. There is considerable variation in different parts of the world. According to Eröss, the mortality in Ireland is but 9.4 per cent. and in Sweden 9.7 per cent; in Saxony, on the other hand, 28.1 per cent., and in Bavaria 28.7. In Russia, according to Gundobin,[3] it is still higher, 32.6 per cent. Budin[4] reports a mortality in the first year for France from 1896 to 1900 of 20.2 per cent., and the statistics of Luling,[5] for Baudelocque's clinic de Paris, give 26.94 per cent. dying in the first year of the 13,952 children born.

That this mortality is largely dependent on disorders of digestion is a suggestive fact. Heimann[6] reports an average from 1897 to 1901 inclusive of 10,993 infants under one year of age dying each year in Berlin, over one-third of them suffering from digestive disorders. In the mortality of Massachusetts from 1892 to 1896, according to S. W. Abbott,[7] diarrheal disorders were responsible for 29.49 per cent. of the deaths in the first year of life. The six-year record for the United States ending 1890 made diarrhea responsible for 21.22 per cent. of the deaths in this period. Budin[4] found that 58.5 per cent of the deaths in the first year in the civic population of France were due to gastro-enteritis.

This brings us naturally to the next point to be considered, the influence of the diet, since it is particularly among the artificially fed infants that gastro-enteric affections prevail. We have reason to expect, then, that the mortality will be found much greater in the artificially fed. That this is the case is well recognized, but a few figures may serve to illustrate to what degree it is true. In the cases reported by Luling,[5] 14.24 per cent.

* Read in the Section on Diseases of Children of the American Medical Association, at the Sixty-Third Annual Session, held at Atlantic City, June, 1912.

1. Eröss: Ztschr. f. Helk., Prague, 1895, xix, 371.
2. Eleventh Census, U. S., 1890, Vital Statistics, i, 22.
3. Gundobin: Jahrb. f. Kinderh., 1898, xlviii, 368.
4. Budin: Ann. de méd. et chir. inf., 1903, vii, 181.
5. Luling: Thèse de Paris, 1900, p. 18.
6. Heimann, quoted by Ebert: Jahrb. f. Kinderh., 1905, lxi, 500.
7. Abbott: Jour. Massachusetts Assn. Boards of Health, December, 1898.